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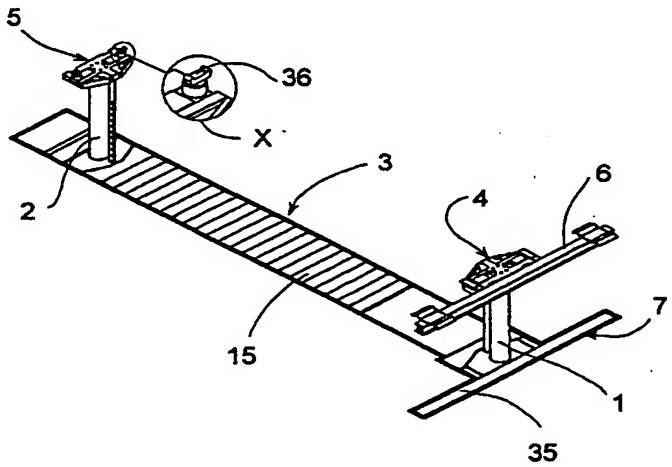
(54) Title: A LIFTING DEVICE FOR VEHICLES



(57) Abstract: A lifting device for lifting vehicles and which comprises an oblong trench (3) accommodated in a floor and over which a vehicle to be lifted can drive with the wheels positioned on each side of said trench. A first, preferably fixedly mounted lifting cylinder (1) with a first support member (4) is provided in the trench (3) or in the floor in extension of said trench. This first support member (4) is adapted to engage the bottom side of the vehicle. At least one second lifting cylinder (2) is placed in the trench (3), said second lifting cylinder being displaceable in the longitudinal direction of the trench (3) and comprising a second support member (5) adapted to engage the bottom side of the vehicle. A lifting beam (6) extending in the transverse direction of the trench (3) and beyond the sides of said trench is connected to the first support member (4) in such a manner that it can be raised together with said first support member (4). A notch (7) is provided in the floor and is adapted to receive the lifting beam (6) in a rest position in which the upper face of said lifting beam (6) substantially flushes with the floor.

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Title: A lifting device for vehicles

Technical Field

The invention relates to a lifting device for vehicles, where the lifting device comprises an oblong trench accommodated in a floor and over which a vehicle to be raised can drive with the wheels positioned on each side of said trench, and where a first, preferably fixedly mounted lifting cylinder with a first support member is placed in the trench or in the floor in extension of said trench, said support member being adapted to engage the bottom side of the vehicle, and where at least one second lifting cylinder movable in the longitudinal direction of the trench is placed in the trench and is provided with a support member adapted to engage the bottom side of the vehicle.

Background Art

Lifting devices of the above type are used for lifting motor vehicles, such as cars, buses and lorries in connection with service and repairs. As one of the lifting cylinders is movable in the longitudinal direction of the trench, the lifting device can be adjusted to vehicles presenting varying distances between the axles. The support members on the two lifting cylinders can be caused to engage the bottom side of the vehicle in various manners. The support members often comprise a supporting plate which can be provided with detachable brackets adapted to engage the wheel axles of the vehicle. Several sets of brackets are often available which have been individually adjusted to one or more types of vehicles. Alternatively brackets on the supporting plate are caused to directly engage the bottom side of the chassis of the vehicle.

Such a lifting device is known from US-PS No. 5,709,286.

The lifting device can also be provided with more than one movable lifting cylinder

so that it can be used for raising vehicles with more than two wheel axles, such as articulated buses.

As mentioned above, such a lifting device can be adjusted to several types of vehicles, but some restrictions do, however, apply. Some vehicles turned out to be very difficult or almost impossible to raise correctly by means of the above lifting device. Problems are in particular attached to vehicles with a very low ground clearance between the bottom of the chassis and the ground. These problems are caused by the lifting brackets protruding too much to allow the vehicle to drive over them or by the positioning of said lifting brackets being difficult as they are not visible or reachable by a person standing next to the vehicle.

A particular type of vehicle is encumbered with problems, viz. the so-called aircraft tractors used for towing aircrafts at the airports. Two main types of aircraft tractors apply: the ordinary aircraft tractors pulling/pushing the aircraft by means of a towbar, and the aircraft tractors without a towbar, i.e. the towbarless tractors. The latter tractors are almost fork-shaped when seen from the top or the bottom, because a notch extends from the rear end and up to half the length of the vehicle. Thus the tractor can be moved to the area adjacent the nose wheel of the aircraft and lift said nose wheel from the ground by means of a particular lifting assembly positioned in the notch between the two "fork legs". The two rear wheels of the tractor are positioned on these "fork legs", and accordingly they have no common wheel axle. In addition, between the rear wheels no chassis members are present which can be engaged by the lifting cylinder of the lifting device. As these aircraft tractors are relatively wide, viz. up to 4 m, and as the lifting device presents an extremely low ground clearance of typically approximately 40 mm, it turned out in practice to be impossible to lift said aircraft tractors by means of conventional lifting devices. Today these aircraft tractors are typically lifted by means of several separate so-called wheel lifts, which is a very slow procedure.

Brief Description of the Invention

The object of the invention is to improve a lifting device of the above type in such a manner that in addition to being suited for lifting ordinary vehicles it is also suited for lifting wide vehicles with a low ground clearance, especially aircraft tractors without a towbar.

The lifting device according to the invention is characterised in that it comprises a lifting beam extending transverse to the trench and beyond the sides of said trench, said lifting beam being connected to the first support member in such a manner that it can be raised together with said first support member, and that a recess is provided in the floor for receiving the lifting beam in a rest position in which the upper face of the lifting beam substantially flushes with the floor. The resulting lifting device can also be used for lifting wide vehicles with a very low ground clearance in connection with service and repair. Even towbarless aircraft tractors can be reliably lifted because at the ends the lifting beam can engage the "fork legs" of the aircraft tractor.

The lifting beam is preferably at least 2 m long, whereby the lifting device can be used for lifting most types of towbarless aircraft tractors. A length of 3.30 m turned out to be particularly advantageous.

According to a preferred embodiment, the lifting beam is connected to the first support member by means of coupling means allowing said lifting beam to disengage the first support member and remain in the rest position when said first support member is raised. As a result the lifting beam need not be raised together with the first support member when an ordinary vehicle, such as a car, lorry or bus is to be lifted by means of the lifting device.

According to a further embodiment of the invention, the first and optionally also the

second support member comprises a supporting plate secured to the top of the lifting cylinder, and two supporting arms adapted to receive detachable lifting brackets, said supporting arms being displaceably mounted on the supporting plate in such a manner that they can be displaced in horizontal direction perpendicular to the longitudinal direction of the trench, where the lifting beam comprises two fork arms with notches extending in the longitudinal direction of the trench and on their respective side of the supporting plate of the first support member, said fork arms being engageable by the supporting arms of the first support member by an outward displacement of the supporting arms while said support member is in a lowered rest position. The resulting structure is very simple, inexpensive and strong because the supporting arms can be provided with lifting brackets so as to lift ordinary lorries and buses. In addition, these supporting arms can be used as additional coupling means when the lifting device is to be used for lifting wide vehicles by means of the lifting beam.

According to a further embodiment of the invention, each support member comprises at least one motor for displacing the supporting arms. As a result it is possible to remote control and correctly position the supporting arms in the transverse direction of the vehicle as well as to remote control the connection and disconnection of the lifting beam.

According to a further preferred embodiment, the coupling means are coupled to the same motor as the supporting arms of the first support member with the result that an outward displacement of the supporting arms in the rest position of the support member by means of the motor simultaneously causes the coupling means of the lifting beam to engage the supporting plate.

The lifting beam is preferably adapted to receive lifting brackets in such a manner that they can be displaced in the longitudinal direction of the lifting beam.

According to yet another preferred embodiment of the invention the first and the

second support members present substantially plane upper faces which in the rest positions of said support members substantially flush with the floor. As a result, a completely plane floor can be obtained which ensures a free driving in of the vehicle to be lifted. In addition, the occupational safety is increased because no parts protrude beyond the floor when the lifting device is not used.

According to the invention, cameras may be built in the support members, and these cameras can be connected to monitors on a control panel in such a manner that the adjusting movement of the support members and the supporting arms can be monitored. The latter is especially advantageous when the lifting device is to be correctly adjusted to a wide vehicle with a low ground clearance.

The lifting device may furthermore comprise transponders which can be mounted at the lifting locations on a vehicle to be lifted, scanners mounted on the supporting arms for scanning the transponders, and a control unit connected to the scanners. Thus during the adjustment of the support members, the scanners transmit a signal to the control unit when a transponder is detected and the correct adjustment has been reached, whereby an automatic adjustment of the support members is be obtained.

Brief Description of the Drawings

The invention is explained in greater detail below by means of a preferred embodiment illustrated in the drawing, in which

Fig. 1 is a perspective view of a lifting device according to the invention in a rest position,

Fig. 2 is a perspective view of the lifting device in a lifting position in which a first and a second support member as well as a lifting beam have been raised into the lifting position by means of a first and a second lifting cylinder,

Fig. 3 is a perspective view of the lifting beam of Figs. 1 and 2 in a lifting position, but where the lifting beam is in the rest position,

Fig. 4 is a perspective view in greater detail of the first support member and the lifting beam,

Fig. 5 is a diagrammatic side view, partly in section, of the first support member with the lifting beam of Fig. 4, and

Fig. 6 is a diagrammatic perspective view of the driving gear of the first support member.

Best Mode for Carrying Out the Invention

The lifting device shown in Figs. 1 to 3 comprises an oblong trench 3, where a first lifting cylinder 1 with a first support member 4 is affixed at one end of said trench, and where a second lifting cylinder 2 with a second support member 5 is movably arranged in said trench in a manner known per se. The two lifting cylinders are preferably hydraulic. A shutter member 15 of steel covers the trench regardless of the position of the movable lifting cylinder 2. Fig. 1 shows the lifting device in the lowered position where the upper face of the support members 4, 5 and a lifting beam or derrick 6 flushes with the floor with the result that said floor is completely plane in practice. Fig. 2 shows the lifting device in a raised position where the lifting beam 6 engages and is consequently lifted together with the first support member 4. This adjustment possibility is used for lifting aircraft tractors without a towbar and other wide vehicles. When the lifting beam is raised, a covering plate 35 automatically follows this upward movement and closes the opening below the lifting beam with the result that the floor remains plane. The second support member 5 is provided with lifting brackets 36 shown in the circle designated x and presenting an enlarged section of Fig. 2. The covering plate is pneumatically or mechanically

lifted. In the same manner it is possible to close the openings below the support members at both the fixed and the movable cylinder. Fig. 3 shows the lifting device with raised support members 4, 5, but where the lifting beam 6 is in the rest position. In this manner the lifting device corresponds to a conventional lifting device and can be used for lifting ordinary vehicles.

Fig. 4 shows the first support member 4 and the lifting beam 6. The first support member 4 comprises substantially a supporting plate 8 and two laterally displaceable supporting arms 9. The lifting beam 6 comprises two fork members 10 projecting perpendicular from said lifting beam and extending on their respective side of the support member 4. The fork members 10 comprise their respective notch which the supporting arm 9 in question can be caused to engage so as to raise the lifting beam 6 together with the support member 4. In Fig. 4, only the supporting arm 9 to the left has been caused to engage the associated fork member 10. In the embodiment shown, each supporting arm 9 is provided with retaining means in form of circular openings 16 for receiving lifting brackets. These lifting brackets are only used when the lifting beam 6 is not to follow the raising of the support member 4, and they can be identical with the lifting brackets 36 of Fig. 2.

When the lifting device is to lift a vehicle by means of the lifting beam 6, the supporting arms 9 are displaced outwardly until they engage the notches of the fork members 10. When the lifting device is to be used without the lifting beam 6, lifting brackets are placed in the openings 16 of the supporting arms 9, whereafter the support member 4 is raised to such a level that it clears the fork members 10 of the lifting beam 6. Subsequently, the supporting arms 9 are adjusted in the transverse direction.

In the illustrated embodiment, the lifting beam 6 comprises an H-section and can be provided with various types of lifting brackets. Fig. 4 shows the lifting beam with two different types of lifting brackets 11, 12, but ordinarily the same type of lifting

bracket is, of course, used at both ends of the lifting beam 6. The lifting bracket 11 shown to the right is adapted to lift the vehicle at the bottom side of the wheels of the vehicle. The lifting bracket 11 shown to the left is adapted to engage parts of the chassis. The upper web of the lifting beam is provided with notches 13 allowing the lifting brackets 11, 12 to be "tilted" into engagement with the lifting beam. Upon the mounting procedure, the brackets 11, 12 can be manually displaced in the longitudinal direction of the lifting beam 6 and consequently in the transverse direction of the vehicle. As the lifting brackets 11, 12 are mounted on the lifting beam 6 by way of a tilting movement it is possible to carry out said mounting after the vehicle has been driven completely or partly over the lifting device. An advantage is thus obtained because vehicles with a very low ground clearance cannot otherwise drive over the lifting beam.

Fig. 5 is a side, partly sectional view of the first support member 4 and the lifting beam 6. The fork member 10 of the lifting beam 6 has been omitted for the sake of clarity. When the lifting beam 6 is used for lifting vehicles, the vertical force is transferred from the lifting beam 6 to the supporting plate 8 through coupling means in form of two pawl members 20, only one pawl member appearing from Fig. 5. The pawl members 20 are displaceably mounted by sliding on the lifting beam 6 by means of a column guideway 21. When the lifting beam 6 is not engaging the supporting plate 8, these pawl members are positioned opposite the notches 14, cf. also Fig. 4, with the result that said supporting plate 8 can be moved up and down without the lifting beam 6. Fig. 5 is a diagrammatic view of how the vertical force F1 is transferred from the lifting beam 6 to the supporting plate 8 in consequence of the weight of the vehicle. The arrow F2 illustrates the force intensity in consequence of the moment from the lifting beam. This moment is absorbed by the supporting arms 9. The position shown in Fig. 5 is the rest position in which the upper face of the lifting beam 6 flushes with the floor 33. In this position the covering plate 35 is pushed down by the lifting beam and abuts the upper face of supporting means 26 which accordingly support said lifting beam 6. In this manner the lifting beam can tolerate

being driven over by a vehicle presenting an axle load of up to 40 tons. In the illustrated embodiment the supporting means 26 are formed by a row of cylindrical blocks.

Fig. 6 is a diagrammatic and perspective view of the driving mechanism for activating one supporting arm and one pawl member 20. The entire driving mechanism is driven by means of a worm-and-wheel motor 30. Through a belt 29, such as a poly-V-belt, the worm-and-wheel motor 30 drives a shaft 41 provided with a gear wheel 25, which engages a rack 24 connected to the bottom side of the supporting arm 9, and a gear wheel 27 driving a rack 23. When the supporting arm is caused to engage the fork member 10 of the lifting beam, cf. Fig. 4, the rack 23 is simultaneously displaced to the right of Fig. 6 and pushes the pawl member 20 to the right with the result that said pawl member 20 engages the supporting plate 8, viz. is removed from the notch 14. The column guideway of the pawl member 20 extends through bearing blocks 22 affixed the lifting beam 6.

The adjustment of the movable lifting cylinder 2 in the longitudinal direction of the trench 3; the adjustment in height of the support members 4, 5; the adjustment of the supporting arms 9; as well as the connecting and disconnecting of the lifting beam 6 can preferably be remote controlled from a central control unit or control panel.

The invention is not restricted to the above embodiment. In stead of placing both lifting cylinders in the same trench, the fixed cylinder can be placed in a separate hole in extension of said trench, i.e. where the displaceable lifting cylinder is placed. This hole need not be of the same width as the trench, but it should not exceed the width of the inner distance between the wheels of an ordinary bus or lorry.

The lifting cylinders are preferably hydraulic, but they can also be purely mechanically operated. More than one displaceable lifting cylinder can, if course, also be used.

Claims

1. A lifting device for vehicles, where the lifting device comprises an oblong trench (3) accommodated in a floor and over which a vehicle to be raised can drive with the wheels positioned on each side of said trench (3), and where a first, preferably fixedly mounted lifting cylinder (1) with a first support member (4) is placed in the trench or in the floor in extension of said trench, said support member being adapted to engage the bottom side of the vehicle, and where at least one second lifting cylinder (2) movable in the longitudinal direction of the trench is placed in said trench and is provided with a second support member (5) adapted to engage the bottom side of the vehicle, c h a r a c t e r i s e d in that a lifting beam (6) extends in the transverse direction of the trench (3) and beyond the sides of said trench, said lifting beam being connected to the first support member (4) in such a manner that it can be raised together with said first support member (4), and that a recess is provided in the floor for receiving the lifting beam (6) in a rest position in which the upper face of the lifting beam (6) substantially flushes with the floor.

2. A lifting device as claimed in claim 1, c h a r a c t e r i s e d in that the lifting beam is at least 2 m long, preferably approximately 3.30 m long.

3. A lifting device as claimed in claim 1 or 2, c h a r a c t e r i s e d in that the lifting beam (6) is connected to the first support member (4) through coupling means (20) allowing said lifting beam to disengage the first support member (4) and remain in the rest position when said first support member (4) is raised.

4. A lifting device as claimed in one of the claims 1 to 3, c h a r a c t e r i s e d in that the first and optionally also the second support member (4, 5) comprises a supporting plate (8) secured to the top of the lifting cylinder (1, 2), and two supporting arms (9) adapted to receive detachable lifting brackets (36), said supporting arms being displaceably mounted on the supporting plate (8) in such a manner that they

can be displaced in horizontal direction perpendicular to the longitudinal direction of the trench (3), and that the lifting beam (6) comprises two fork members (10) with notches extending in the longitudinal direction of the trench (3) and on their respective side of the supporting plate (8) of the first support member (4), said fork members (10) being engageable by the supporting arms (9) of the first support member (4) by an outward displacement of the supporting arms (9) while said support member (4) is in a lowered rest position.

5. A lifting device as claimed in claim 4, c h a r a c t e r i s e d in that each support member (4, 5) comprises at least one motor (30) for displacing the supporting arms (9).

6. A lifting device as claimed in claim 5, c h a r a c t e r i s e d in that the coupling means (20) are coupled to the same motor (30) as the supporting arms (9) of the first support member (4) in such a manner that an outward displacement of the supporting arms (9) in the rest position of the support member (4) by means of the motor simultaneously causes the coupling means (20) of the lifting beam (6) to engage the supporting plate (8).

7. A lifting device as claimed in one or more of the preceding claims, c h a r a c t e r i s e d in that the lifting beam (6) is adapted to receive lifting brackets (11; 12) in such a manner that they can be displaced in the longitudinal direction of the lifting beam (6).

8. A lifting device as claimed in one or more of the preceding claims, c h a r a c t e r i s e d in that the first and the second support member (4, 5) comprise substantially plane upper faces which in the rest position of the support members (4, 5) substantially flush with the floor.

9. A lifting device as claimed in one or more of the preceding claims, c h a r a c -

terised in that cameras are built in the support members (4, 5), where said cameras can be connected to monitors on a control panel with the result that the adjustment movement of the support members (4, 5) and the supporting arms (9) can be monitored.

10. A lifting device as claimed in one or more of the preceding claims, characterised in that it comprises transponders which can be mounted at the lifting location on a vehicle to be lifted; scanners mounted on the supporting arms (9) for scanning the transponders; and a control unit connected to the scanners.

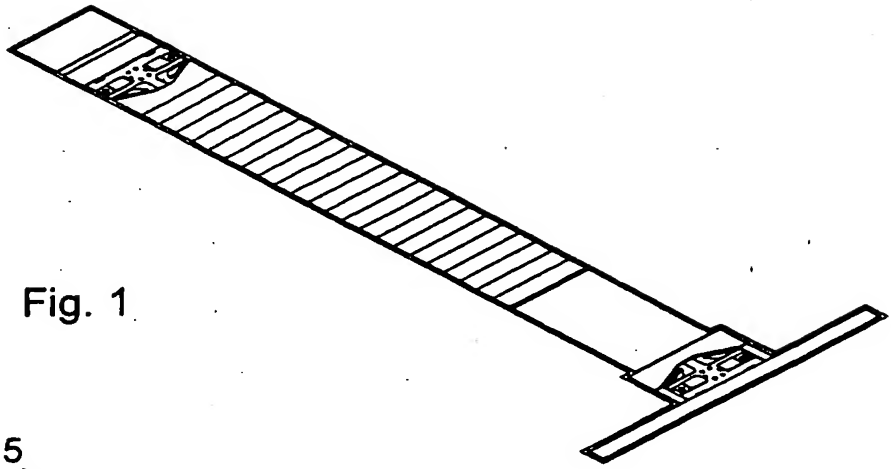

Fig. 1

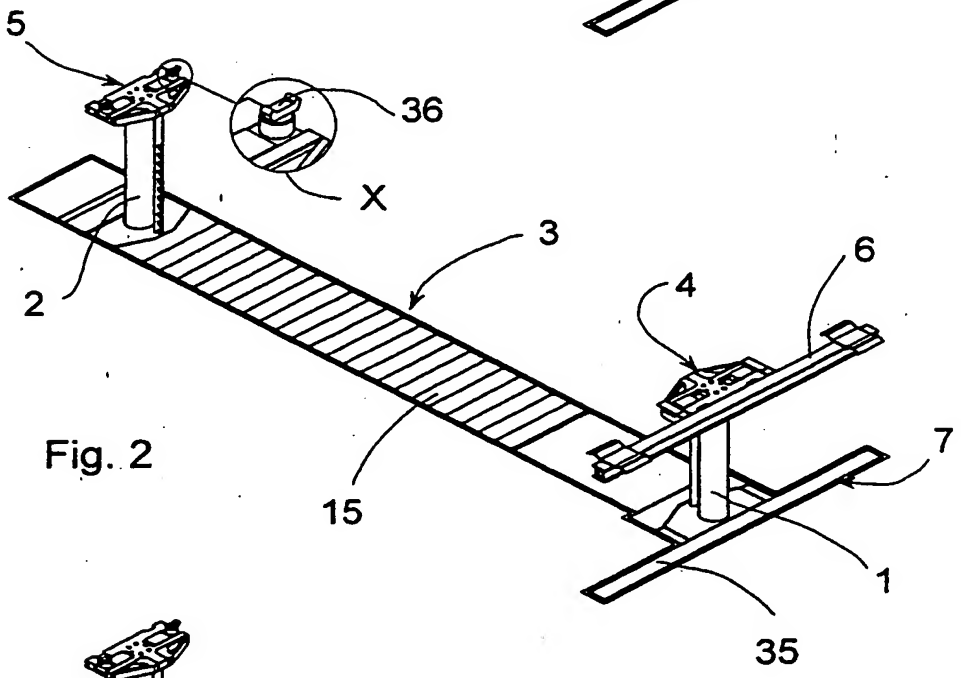

Fig. 2

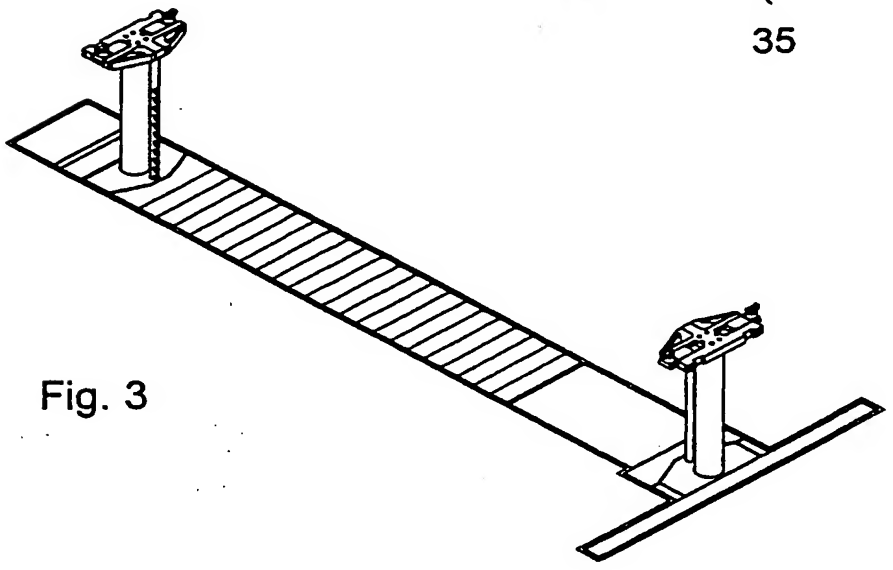

Fig. 3

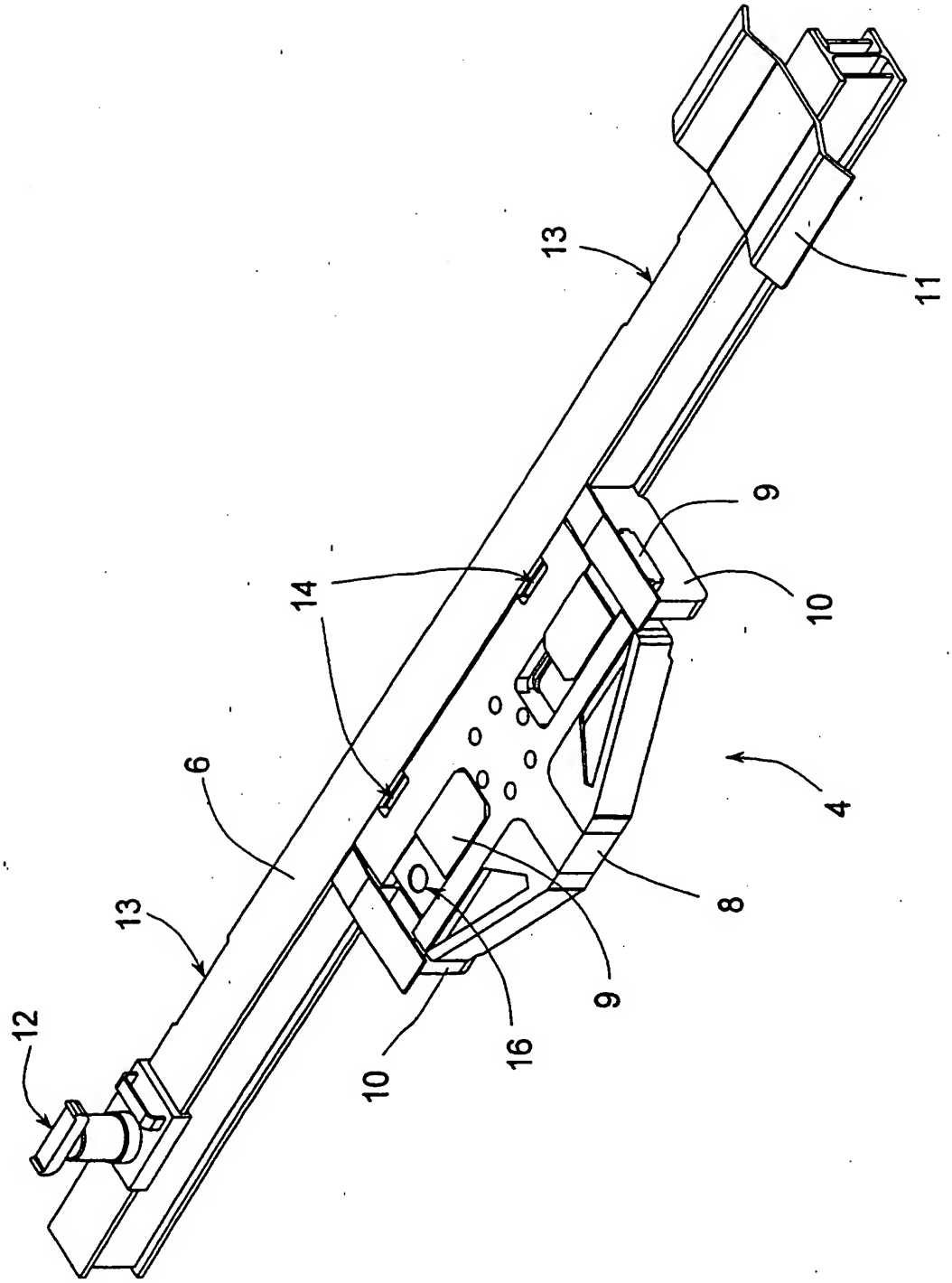

Fig. 4

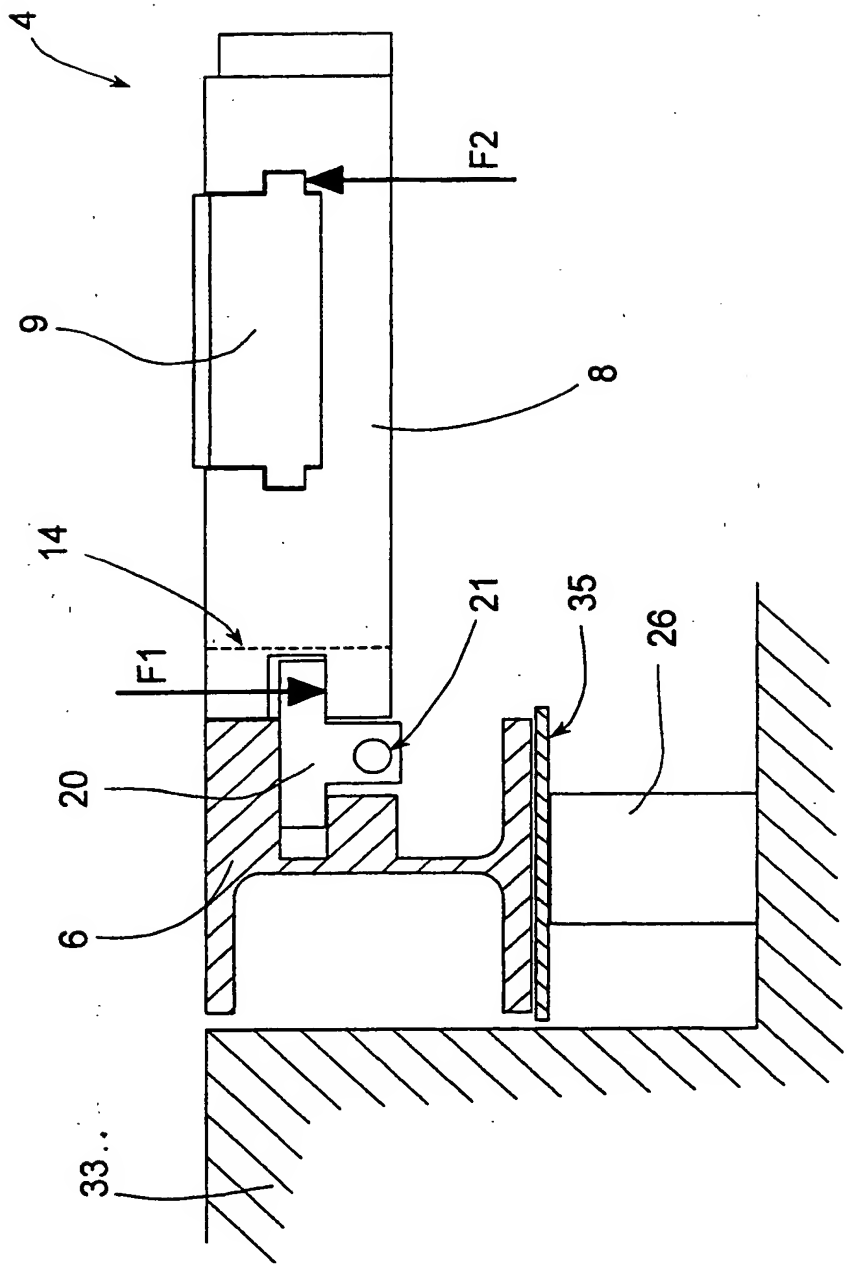

Fig. 5

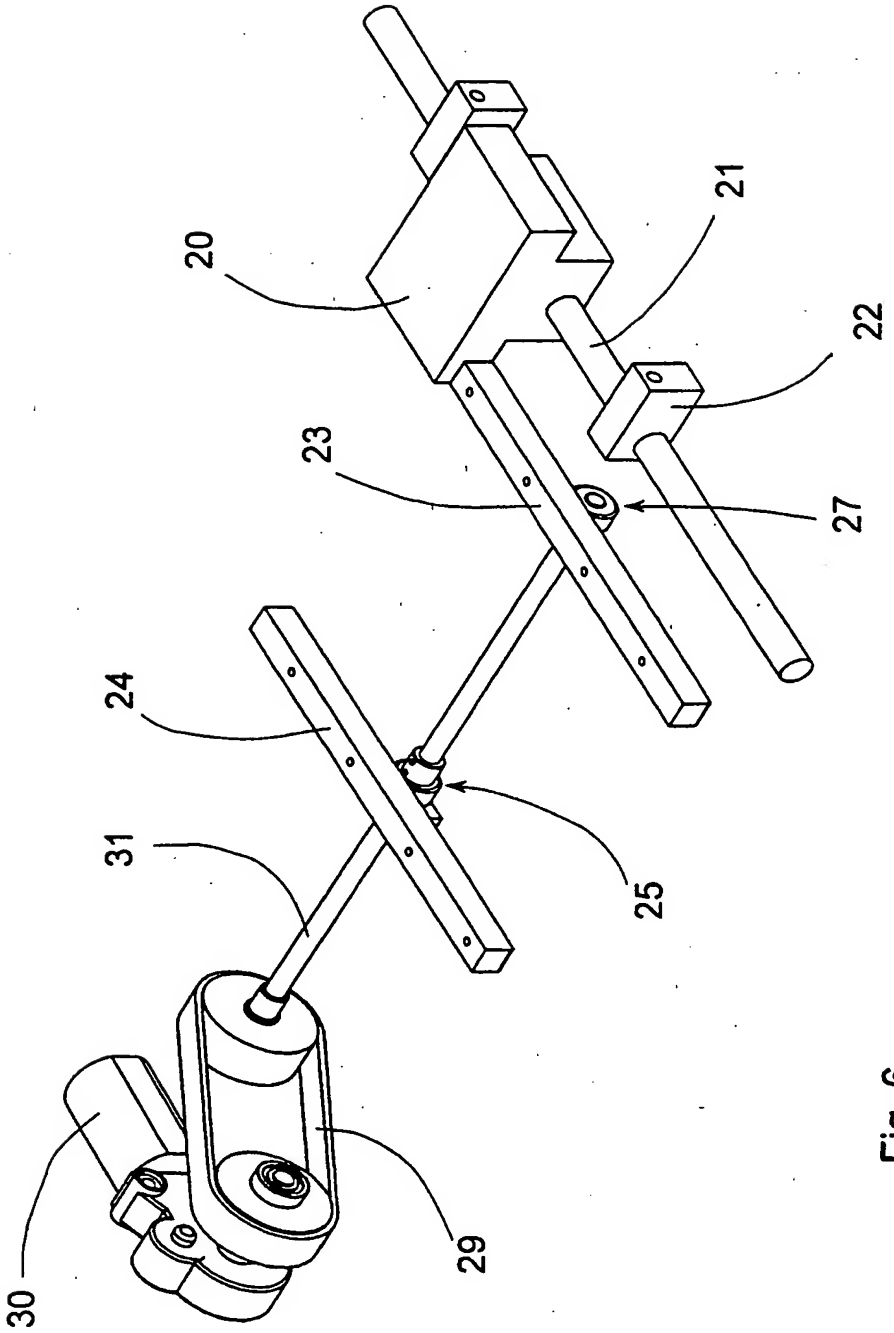

Fig. 6

INTERNATIONAL SEARCH REPORT

Intern nal Application No
PCT/DK 01/00066

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 B66F7/28 B66F7/20

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 B66F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 5 052 520 A (WAKAMIYA KOJI) 1 October 1991 (1991-10-01) column 2, line 25 - line 66 column 3, line 43 - line 46 abstract; figures 1-3	1-3,7-10
Y	US 2 593 630 A (THOMPSON E B) 22 April 1952 (1952-04-22) column 5, line 39 - line 54; figures 10,14	1-3,7-10
Y	US 2 112 481 A (COX L C) 29 March 1938 (1938-03-29) page 2, line 7 - line 38; figures 1,4,6	3

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[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

° Special categories of cited documents :

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Date of the actual completion of the international search
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Date of mailing of the international search report
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INTERNATIONAL SEARCH REPORT

Intern: nal Application No
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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	PATENT ABSTRACTS OF JAPAN vol. 017, no. 656 (M-1521), 6 December 1993 (1993-12-06) & JP 05 213588 A (BRIDGESTONE CORP), 24 August 1993 (1993-08-24) abstract; figure	9,10
Y	US 5 709 286 A (MEAD R W ET AL) 20 January 1998 (1998-01-20) column 4, line 44 - line 52; figure 4	1-3,7-10
Y	US 2 498 304 A (SOMMER H C) 21 February 1950 (1950-02-21) figures 1-11	1-3,7-10
Y	US 3 831 713 A (CLARKE J E) 27 August 1974 (1974-08-27) abstract; figures 1,2,9,13	1-3,7-10

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.
PCT/DK 01/00066

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US 2593630 A	13/12/48	NONE	
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US 2498304 A	08/04/47	NONE	
US 3831713 A	27/08/74	NONE	